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U/Pb SIMS zircon dating of a rhyolite intercalation in Permian siliciclastics as well as a rhyodacite dyke in micaschists (Infratatricum, W. Carpathians)

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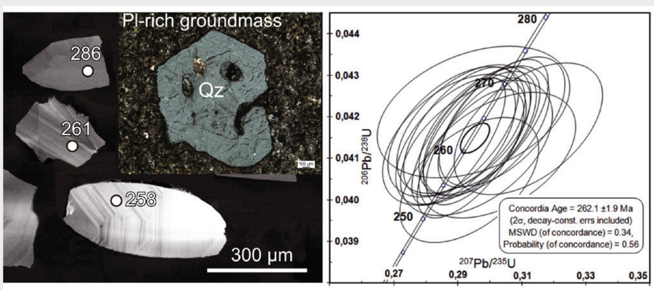
Abstract: The Infratatric Inovec Nappe in northern part of the Považský Inovec Mts. (Central Western Carpathians) is built of basement kyanite(sillimanite-andalusite)-garnet micaschists to gneisses, which are covered by the lithologically variable siliciclastic Late Carboniferous and Permian sediments. The U/Pb SIMS zircon ages of a rhyolite as well as surrounding pyroclastics, present as intercalations in Permian siliciclastic sediments, were compared with the age of a rhyodacite dyke crosscutting the basement micaschist gneisses. Despite reported differences in the petrographic and chemical (major elements) composition of dated volcanic rocks, the obtained U/Pb SIMS zircon ages are unified in a narrow time interval from ca 267 to 262 Ma, indicating a relatively short-lived volcanic event. Similarly, the normalized REE and multielement (spider) trace element diagrams with slightly enriched LREE and rather low Y (Yb, Nb, Ta) content as well as weak Eu anomaly could indicate an arc-type volcanic rocks. Rhyodacite dyke however, showing no fractionation (no Eu anomaly), approaching primary quartz diorite/tonalite melt composition, suggests the within plate acid volcanism. Such kind of volcanism is typical for the Pangea continental margin breakdown and rift-related volcanism. Also this feature, besides the grade of Alpine tectonometamorphic overprint, strongly differentiates the Infratatric Unit from the overlying Tatric Unit.

Key words: acid volcanic rocks, zircon, U/Pb SIMS, Infratatricum, Western Carpathians

Graphical abstract



SIMS U/Pb zircon dating of a subalkaline rhyodacite dyke revealed an age of Permian continental rifting

Highlights

- Petrography and geochemistry of Permian acid volcanic rocks of the Infratatric Unit, Western Carpathians
- U/Pb SIMS zircon Guadalupian (Wordian to Capitanian) ages of acid volcanic rocks
- Continental volcanic arc- and within-plate type geodynamic setting

Geological setting

The Infratatric (IFTA) Unit (Putiš, 1992) of the Central Western Carpathians is a basement/cover structural complex overridden by the Tatric Unit along the Hrádok-Zlatníky thrust-fault zone, the latter unit later (after Turonian) being overthrust by the Fatric and Hronic nappes. The Infratatric Unit was called Carpathian Penninic by Leško et al. (1988), because the Tatric Unit was considered analogous to the Lower Austroalpine Unit underlain with the Penninic Unit in the Eastern Alps (e.g. Tollmann, 1980).

The IFTA Unit is composed of the higher Inovec and the lower Belice nappes, exposed in the Miocene horst of the Považský Inovec Mts. (Fig. 1). The Inovec Nappe micaschist-gneiss basement is covered by the Late Carboniferous to Middle Triassic sedimentary rocks (Putiš, 1983). Much complete Permian to Early Cretaceous Humienec Succession was reconstructed from the underlying Belice Nappe, where the Late Cretaceous hemipelagic and pelagic clayey, cherty-clayey and flysch sediments (Kullmanová and Gašpariková, 1982; Plašienka et al., 1994; Putiš et al., 2006, 2008) contain large slices and olistolith blocks derived from this succession. Plašienka (2012) considers the whole succession of the Belice Nappe more or less stratigraphically continuous (the Humienec unit by Putiš in Leško et al., 1988), representing the Váhic Oceanic Unit, despite a true oceanic crust with N-MORB has not been found. The Middle/Late Jurassic to Early Cretaceous members of this succession occur as clasts to olistolith fragments refolded with flysch. The reported "continuity" from the Early to Late Cretaceous is however broken due to a mid-Cretaceous tectonometamorphic event. Different metamorphic grade was found between the Permian to Early Cretaceous siliciclastic or volcanic fragments in the flysch sequence on the one hand, and the Late Cretaceous Couches-Rouges type and flysch shaly sediments on the other hand (Putiš, 1986; Putiš et al., 2006, 2008; Sulák et al., 2009). Therefore a hiatus between the reconstructed Permian to Early Cretaceous Humienec Succession and the Late Cretaceous Belice Succession should be taken into account. Pelech et al. (2016) consider a continuation of the Gosau-type sediments from the Brezová Mts. eastwards up to the "Tatricum" of the Považský Inovec Mts. Selec Block.

The Inovec Nappe is overthrust with the Tatric Unit overloaded with the Mesozoic Fatric and Hronic nappes (Plašienka et al., 1997). In fact, this is a Miocene tectonic window dated to 21–13 Ma by the apatite fission-track (FT) ages (Danišík et al., 2004). The only exception is the southernmost Považský Inovec Mts. Hlohovec Block, which yielded apatite FT age of 41 Ma, compatible with the apatite cooling ages (below ca. 125–100 °C) from 44 to 35 Ma also determined in the Malé Karpaty and Tribeč Mts. (Danišík et al., 2004). Only rare exposures of Paleogene formations covering the Tatric Panská javorina Nappe including the overlying Hronic (Choč) Nappe are preserved in the study area. The IFTA Inovec Nappe lacks the Paleogene sediments, because at that time it was underneath the Tatric Unit overloaded with the Mesozoic Fatric and Hronic nappes as a lid. The Fatric and Hronic nappe fragments may have been gravitationally slided on the already being exhumed IFTA Unit most likely since the Paleogene-Neogene boundary period.

Termination of the Eocene tectonometamorphic overprint (Putiš et al., 2006, 2008), dated by newly formed celadonite-poor muscovite (3.1–3.2 Si pfu; Sulák et al., 2009) $^{40}Ar/^{39}Ar$ plateau age of 48 ± 2 Ma from the Tatric Unit hanging wall greenschist-facies granite blastomylonites (ca 300 °C at minimum 4 – 5 kbar; Putiš et al., 2009; 25 °C/km gradient), is registered in zircon FT cooling ages (below ca 250–200 °C) of 47 – 37 Ma from the Inovec Nappe, according to unpublished data set. This event was also detected in a basalt olistolith from the Late Cretaceous flysch close to Humienec Hill by the whole-rock K/Ar age of 46±3 Ma (Putiš et al., 2008). The Cenomanian to Maastrichtian Belice Basin closed and the lower IFTA Belice Nappe has formed being part of the growing Cretaceous–Eocene accretionary wedge most likely due to foreland Magura Unit heavy crust southward subduction.

The lowest anchimetamorphic conditions were achieved in the lower IFTA Belice Nappe underthrust below the higher IFTA Inovec Nappe, being overloaded with the Tatric, Fatric and Hronic nappes. The Belice Nappe Couches-Rouges type shales and flysch sediments contain newly formed white mica (3.13–3.29 Si pfu) of illite-phengite composition with the very low (K+Na) values from 0.5 to 0.7 pfu and K_2O from 5 to 7 wt.%, being typical for the diagenesis, but also for the lowest-temperature metamorphic overprint (150–200 °C at 4–5 kbar; ca 12 °C/km gradient).

However, the basement micaschists and the Late Carboniferous to Early Cretaceous cover rocks (including the reconstructed Humienec Succession) of the Inovec Nappe show an older, mid-Cretaceous, higher-temperature and medium-pressure anchi-metamorphic overprint reported by Putiš (1981, 1986), Korikovsky and Putiš (1999), Putiš et al. (2006, 2008) and Sulák et al. (2009). For example, the presence of illite-phengite (3.21–3.45 Si pfu) with (K+Na) values from 0.7 to 0.8 pfu and K_2O from 8 to 9 wt.% in the Early Cretaceous slates (clast to km-size fragments in late Santonian to Maastrichtian flysch) indicates medium-anchimetamorphic conditions of 200–270 °C at minimum medium pressure of 5–6 kbar (Putiš et al., 2008; Sulák et al., 2009) or burial to ca 15–20 km depth (15 °C/km gradient). The newly formed white mica of metamorphic illite-phengite to normal phengite (=celadonite-rich muscovite) composition, yielded $^{40}Ar/^{39}Ar$ plateau ages of 114.0±2.4 and 106.2±3.7 Ma (Putiš et al., 2009), constraining well a late Early Cretaceous ("mid-Cretaceous") metamorphic event. The age of 101.2±2.9 Ma was directly obtained from the Permian meta-sandstone phengite (sample PI-4, Hôrka Valley), 1 km to NW of dated meta-rhyolite body (samples PI-R11a, b). These $^{40}Ar/^{39}Ar$ ages are coeval with the termination of the Jurassic–Early Cretaceous Humienec Basin Succession and an accretionary wedge formation in front of the Tatric Unit. The underthrusting of the IFTA Inovec Nappe below the north-Tatric nappes is recorded by the age of 102.3±1.9 Ma from the Tatric Unit hanging wall granite blastomylonite white micas. The metamorphosed rocks of this Cretaceous wedge are represented by the higher IFTA Inovec Nappe, recently exposed north of the Hrádok-Zlatníky line (= the thrust fault of the Tatric Unit over the IFTA Unit), including inferred frontal Humienec tectonic slice composed of Permian to Early Cretaceous Humienec Succession, the rock fragments of which exclusively occur in the Late Cretaceous flysch (Putiš et al., 2008). The outlined metamorphic gradients in this syn-orogenic accretionary wedge (Putiš et al., 2008) are typical for the subduction related accretionary wedges (Peacock, 1987; Platt, 1993).

The Permian siliciclastics of the Inovec Nappe contain numerous prolonged lensoidal km-size bodies of basic and acid volcanic rocks discovered and mapped by Putiš (1981, 1986) in a wider area E of Hôrka nad Váhom village, between Hrádocká and Krajná valleys in the middle part of the mountains (Fig. 1; see also Geological Map of the Považský Inovec Mts., Ivanička et al., 2007). Smaller bodies of basic and acid volcanics in Permian siliciclastics occur as infolded ones in the basement micaschist-gneisses NE of Čierny Hill. A rhyodacite dyke crosscuts micaschist-gneisses N of Inovec Hill. Polák (1956) called this rhyodacite dyke dacite, and Hovorka (1960) as quartz porphyrite. Next dykes of this type were found by Putiš (1981) to the W and N of Inovec Hill (Fig. 1), which suggests a presence of the rhyodacite dyke swarm. Similar basic and acid volcanic rocks are known from olistoliths in the Late Cretaceous red clayey, cherty-clayey and flysch sediments of the Belice Succession (Putiš et al., 2006, 2008), e.g. close to Humienec Hill or NE of Hradisko Hill (Fig. 1).

The aim of this paper is to present new U/Pb SIMS zircon ages from a rhyolite body in the Permian siliciclastics from the wider area of Hôrčanská dolina Valley and to compare these ages with the age of rhyodacite dyke emplaced in micaschist-gneiss basement rocks, covered by the Permian volcano-sedimentary rocks. Additional information concerns a brief petrographic and geochemical characteristics used for geodynamic interpretation of dated volcanic rocks.

Methodics

The choice of samples for radiometric dating was done on the basis of own mapping and publications (Putiš, 1981 – 1986; Putiš et al., 2006, 2008). The GPS sample location: PI-RD1 N 48°47.500´, E 18°03.229´, 796 m a.s.l.; PI-R11a N 48°42.972´, E 17°57.314´, 380 m a.s.l.; PI-R11b N 48°42,972´, E 17°57,314´, 380 m a.s.l.

The samples were crushed to fine-grained fractions used for zircon separation finally under a binocular at the Earth Science Institute of Slovak Academy

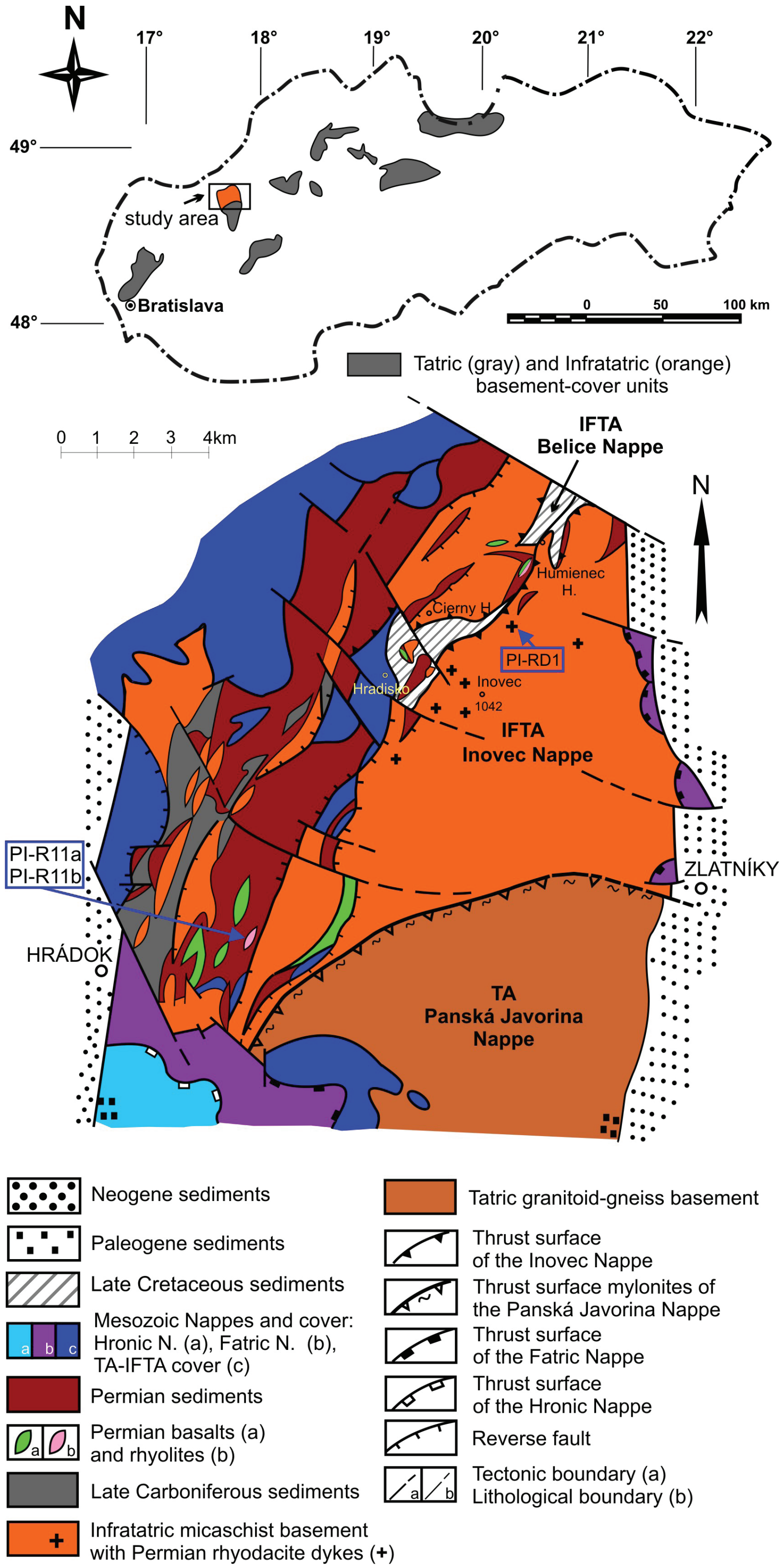


Fig. 1. Geological map of the Považský Inovec Mountains (after Putiš, 1981, 1983, 1986; Putiš in Krist et al., 1992, completed) with dated samples location. TA = Tatric Unit, IFTA = Infratatric Unit.

of Sciences in Banská Bystrica. The pulp samples were analysed for major, trace, and rare earth element (REE) contents, as well as for total carbon, sulfur, and loss-on-ignition (LOI) in ACME Laboratories Ltd. in Vancouver in Canada. Two instruments for inductively coupled plasma optical emission spectrometry (ICP-OES) and inductively coupled plasma mass spectrometry (ICP-MS) were used for the whole-rock geochemical analyses (Tab. 1).

Zircon crystals were mounted in a transparent epoxy and polished in order to expose the fresh interior of the crystals. An epoxy mount was coated with high-purity gold to reach b20 Ω resistance prior to SIMS analysis. Images of zircon crystals under translucent and reflective light and CL images were available for careful spot choice avoiding fractures and inclusions. Measurement of U/Pb analyses of zircons were performed using Cameca IMS-1280HR SIMS at Institute of Geology and Geophysics, Chinese Academy of Sciences in Beijing. The complete Instrument description and analytical procedure can be found in Li et al. (2009). The O_2^- primary ion beam was approximately 20 × 30 μm in size. Positive secondary ions were extracted with a 10 kV potential. A mass resolution of ca. 5400, defined at 10 % peak height was used to separate Pb^+ peaks from isobaric interferences. A single electron multiplier was used in ion-counting mode to measure secondary ion beam intensities by peak jumping mode. Pb/U calibration was performed relative to zircon standard Plešovice ($^{206}Pb/^{238}U$ age = 337 Ma, Sláma et al., 2008). U and Th concentrations were calibrated against zircon standard 91500 (Th = 29 ppm, and U = 81 ppm, Wiedenbeck et al., 1995). Measured compositions were corrected for common Pb using non-radiogenic ^{204}Pb. Corrections are sufficiently small to be insensitive to the choice of common Pb composition, and an average of the present-day crustal composition (Stacey and Kramers, 1975) is used for the common Pb assuming that the common Pb is largely surface contamination introduced during sample preparation. In order to monitor the external uncertainties of SIMS U-Pb zircon dating calibrated against Plešovice standard, a zircon standard Qinghu was alternately analysed as one of the unknowns. Twenty-two measurements on Qinghu zircon yield a Concordia age of 160 ± 1 Ma, which is identical within an error with the recommended value of 159.5 ± 0.2 Ma (Li et al., 2013). Analytical uncertainties were within 2 %. Concordia U-Pb ages are quoted with 95 % confidence interval. All Concordia ages and diagrams were generated using Isoplot/Ex v. 2.49 program (Ludwig, 2001).

Obtained results

The meta-rhyolite (sample PI-R11a) from the Hôrčanská Valley area belongs to Permian cover of the IFTA Inovec Nappe. The narrow about 20 metre exposed wide body

Tab. 1
The whole-rock chemical analyses of studied samples. MDL – the minimum detection limits.

Sample		PI-R11a	PI-R11b	PI-RD-1
wt. %	MDL			
SiO_2	0.01	76.94	72.04	57.63
TiO_2	0.01	0.11	0.31	1.51
Al_2O_3	0.01	11.69	13.87	16.08
Cr_2O_3	0.002	<0.002	<0.002	0.025
Fe_2O_3	0.04	0.56	2.67	8.48
MnO	0.01	0.04	0.04	0.06
MgO	0.01	0.05	0.44	5.66
CaO	0.01	1.94	1.04	0.74
Na_2O	0.01	6.36	5.36	3.54
K_2O	0.01	0.21	0.16	1.67
P_2O_5	0.01	0.06	0.16	0.48
LOI	-5.1	2.0	1.6	3.8
Total		99.96	99.93	99.56
ppm				
As	0.5	<0.5	2.1	2.2
Ba	1	114	215	185
Be	1	<1	4	3
Bi	0.1	<0.1	<0.1	0.4
Cd	0.1	<0.1	<0.1	<0.1
Co	0.2	0.5	2.1	41.3
Cs	0.1	0.6	1.9	3.9
Cu	0.1	<0.1	0.8	35.2
Ga	0.5	15.0	17.4	19.1
Hf	0.1	2.5	5.0	3.5
Hg	0.01	<0.01	<0.01	<0.01
Mo	0.1	<0.1	<0.1	<0.1
Nb	0.1	5.9	13.4	26.0
Ni	0.1	0.6	2.9	115.5
Pb	0.1	0.5	2.7	11.2
Rb	0.1	9.3	71.4	99.2
Sb	0.1	<0.1	0.4	0.2
Sc	1	3	6	17
Se	0.5	<0.5	<0.5	<0.5
Sn	1	5	9	19
Sr	0.5	11.7	55.9	47.5
Ta	0.1	1.6	1.4	3.3
Th	0.2	9.0	15.1	2.3
Tl	0.1	<0.1	<0.1	<0.1
U	0.1	1.1	1.5	4.4
V	8	<8	22	129
W	0.5	1.3	3.7	3.9
Y	0.1	16.2	27.4	28.3
Zn	1	2	15	204
Zr	0.1	82.6	198.4	148.4
La	0.1	61.2	41.6	18.6
Ce	0.1	133.7	89.6	39.3
Pr	0.02	15.71	10.42	4.95
Nd	0.3	55.0	38.7	21.0
Sm	0.05	10.09	7.93	4.63
Eu	0.02	1.55	0.89	1.42
Gd	0.05	5.63	6.34	4.78
Tb	0.01	0.61	0.91	0.81
Dy	0.05	3.08	5.19	4.99
Ho	0.02	0.54	0.88	0.98
Er	0.03	1.72	2.72	2.73
Tm	0.01	0.26	0.38	0.40
Yb	0.05	1.79	2.41	2.39
Lu	0.01	0.28	0.37	0.38
ΣREE		291.16	208.34	107.36

contains pinkish colour porous to massive fine-grained glassy rhyolite. Microscopically, it has a well preserved porphyritic texture of quartz, feldspars and biotite in fine grained partly recrystallized groundmass (Fig. 2a, b).

Meta-rhyolite pyroclastic rock (sample PI-R11b) represents medium to coarse-grained marginal part of the fine-grained to glassy rhyolite (sample PI-R11a) from the same locality. Macroscopically, the mm to cm scale mineral and rock (rhyolite) fragments are distinguishable. Microscopically, it has well preserved clastic texture of quartz, feldspars and biotite, including rhyolite rock fragments, emplaced in fine grained partly recrystallized matrix (Fig. 2c, d).

Meta-rhyodacite north of Inovec Hill (sample PI-RD1) occurs as a few metre wide dyke crosscutting the Inovec Nappe basement micaschist-gneiss, the latter forming mm- to cm-size microxenoliths in the dyke. This fine-grained rock has a typical dark-green colour with macroscopically visible rare quartz grains. Microscopically, the rock has well preserved porphyritic texture of feldspars and biotite, less quartz, present in the fine-grained aggregate of lath-shape sodic plagioclase, partly to totally replaced by newly formed fine-grained white mica. In comparison with the meta-rhyolite from Hôrčanská Valley, they are richer in plagioclase that dominate in the groundmass (Fig. 2e, f). Kalifeldspar occurs only as phenocrysts.

The studied subalkaline silica-oversaturated acid volcanic rocks are projected in the rhyolite (samples PI-R11a, b) or andesite fields (sample PI-RD1) in TAS diagram (LeBas et al., 1986; Fig. 3a), or in rhyolite (samples PI-R11a, b) and rhyodacite (sample PI-RD1) fields in the diagram of De La Roche et al. (1980; Fig. 3b).

The chondrite normalized REE patterns (normalization after Sun and McDonough, 1989) show slightly increased LREE content. Rhyolite samples display a week negative Eu anomaly, while rhyodacite has no Eu anomaly (Fig. 3c). In multielement (spider) diagram (Fig. 3d) positive anomalies of Ba, Th, U, Pr, Nd and Sm are detectable, in comparisom with depleted contents of Cs, Pb, Nb, As, Sr and Sc, exhibiting negative anomalies.

The rhyolite samples were projected to volcanic arc area, while the rhyodacite sample lies at the boundary between the volcanic arc and within plate areas in diagrams of Pearce et al. (1984; Fig. 4a-d) for granitoid rocks.

The dated oscillatory zoned zircon from rhyolite sample PI-R11a yielded an age of 262.4±2.1 Ma (Fig. 5a, b). The dated oscillatory zoned zircon from pyroclastic rhyolite sample PI-R11b provided an age of 266.5±1.9 Ma (Fig. 5c, d). The dated oscillatory zoned zircon from rhyodacite dyke exhibits an age of 262.1±1.9 Ma (Fig. 5e, f). The usual grain size of dated zircon was from 100 to 300 μm.

Discussion

Rhyolite rock samples (including rhyolite pyroclastics) were confirmed in both chemical classification diagrams (Fig. 3a and 3b). A problem has arisen with the third rhyodacite-type sample in the TAS diagram (Fig. 3a). Despite the rare occurrence of the quartz phenocrysts (Fig. 2f), the relatively low content of SiO_2 (Tab. 1) shifted this quartz-bearing rock to andesite field. A slight decrease in SiO_2 can be ascribed to a metamorphic overprint and accompanying Si mobility. A loss of SiO_2 (of about 5 wt.%) might have caused the shift from the dacite (rhyodacite) to andesite field. In classification diagram of De La Roche et al. (1980; Fig. 3b) this rock already occurs in rhyodacite field that is more consistent with the mineral composition of the dyke. Because of this reason we call it "rhyodacite" in agreement with Putiš (1981).

Documented normalized trace element patterns (Fig. 3c, d) are compatible with the areas of supra-subduction volcanism with the melted sources of continental crust. The chemical composition from quartz diorite/tonalite to granite may indicate different sources of volcanic rocks subjected to a different degree of fractionation. Rhyodacite however shows no fractionation, approaching primary quartz diorite/tonalite melt composition projected in within plate acid magmatism field (Fig. 4a, b) or on the boundary between volcanic arc and within plate acid magmatism (Fig. 4c, d). Rhyolites yield a week negative Eu anomaly (around 0.2) consistent with a slightly fractionated granite source. The anchi-metamorphic conditions (Putiš, 1986; Putiš et al., 2008), achieved in the Inovec Nappe, were not sufficient for a more distinct mobility of the trace (including REE) elements and the rocks preserve well an original magma character, or the melt sources. The obtained zircon ages therefore represent the time of magmatic emplacement and magmatic crystallization of rhyolite and rhyodacite.

The ages of studied IFTA samples are consistent with the zircon age data of Permian volcanic rocks from northern Veporicum (Kotov et al., 1996; Vozárová et al., 2016), Gemericum and Meliaticum (Vozárová et al., 2009, 2012) as well as from higher Mesozoic nappes (in preparation). They seem to be related to a global extension event or Pangea supercontinent breakdown (e.g., Stampfli, 1996; Golonka, 2007) triggered by the NW-ward Paleotethys oceanic crust subduction. This event is often considered as a pre-orogenic phase of the new - Alpine orogenic cycle (e.g., Putiš et al., 2000). Comparison of the chemical composition of Permian volcanic rocks could indicate two different areas of Permian volcanism in the Central and Inner Western Carpathians. The area of northern Gemericum, Veporicum and Infratatricum exhibits predominated arc type acid volcanics depleted in Y, Yb, Nb and Ta. On the other hand in general small Eu anomaly values (usually less than 0.5) and low fractionation degree is not in a strong controversion with the riftogenic volcanics. The area of southern Gemericum and Meliaticum shows a more typical riftogenic acid volcanics characteristic for a within-plate paleotectonic environment (Vozárová et al., 2009, 2012), with an increased Y, Yb, Nb and Ta.

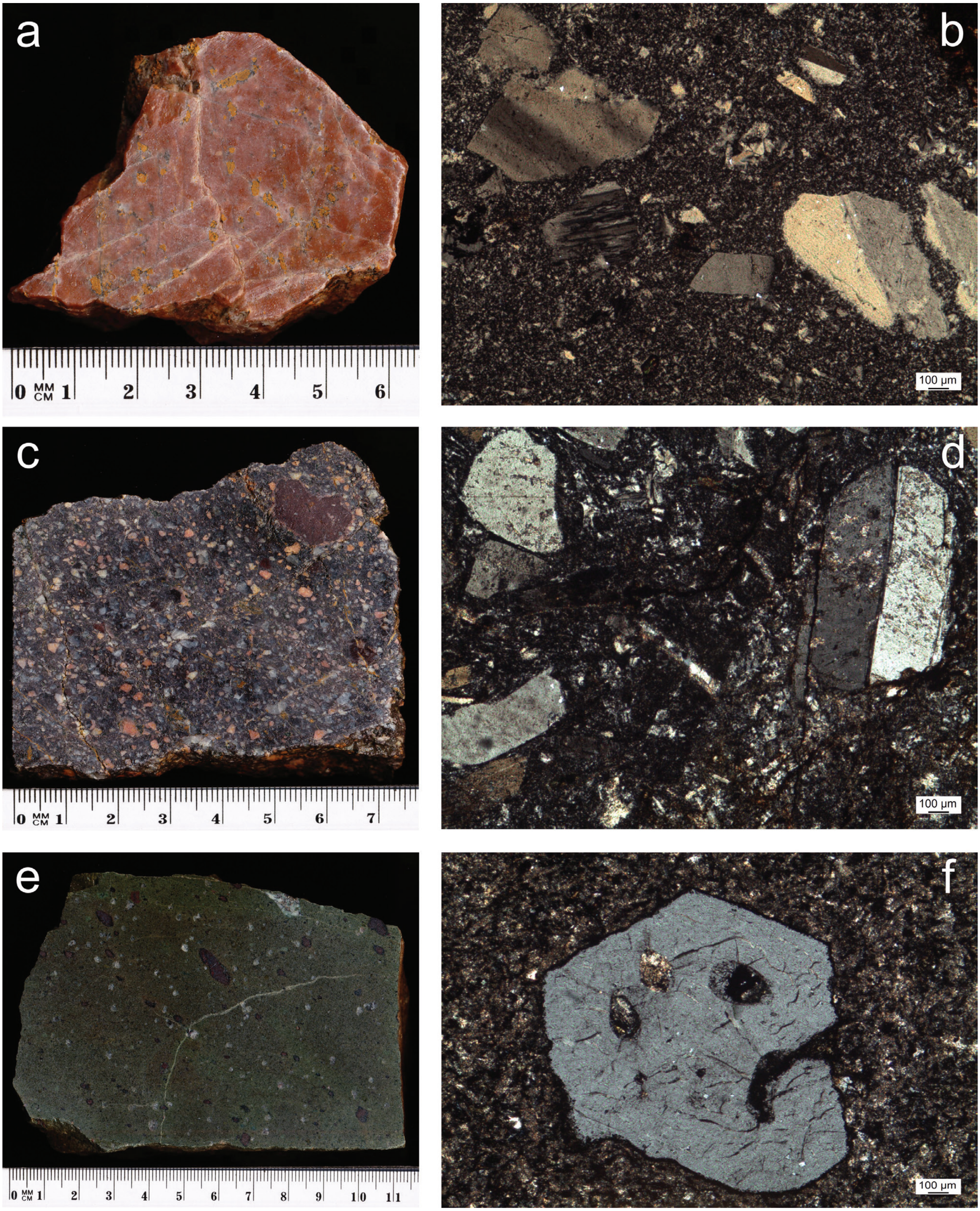


Fig. 2. Macro- and micro-images of dated rocks: a – b, PI-R11a, c – d PI-R11b, e – f PI-RD1.

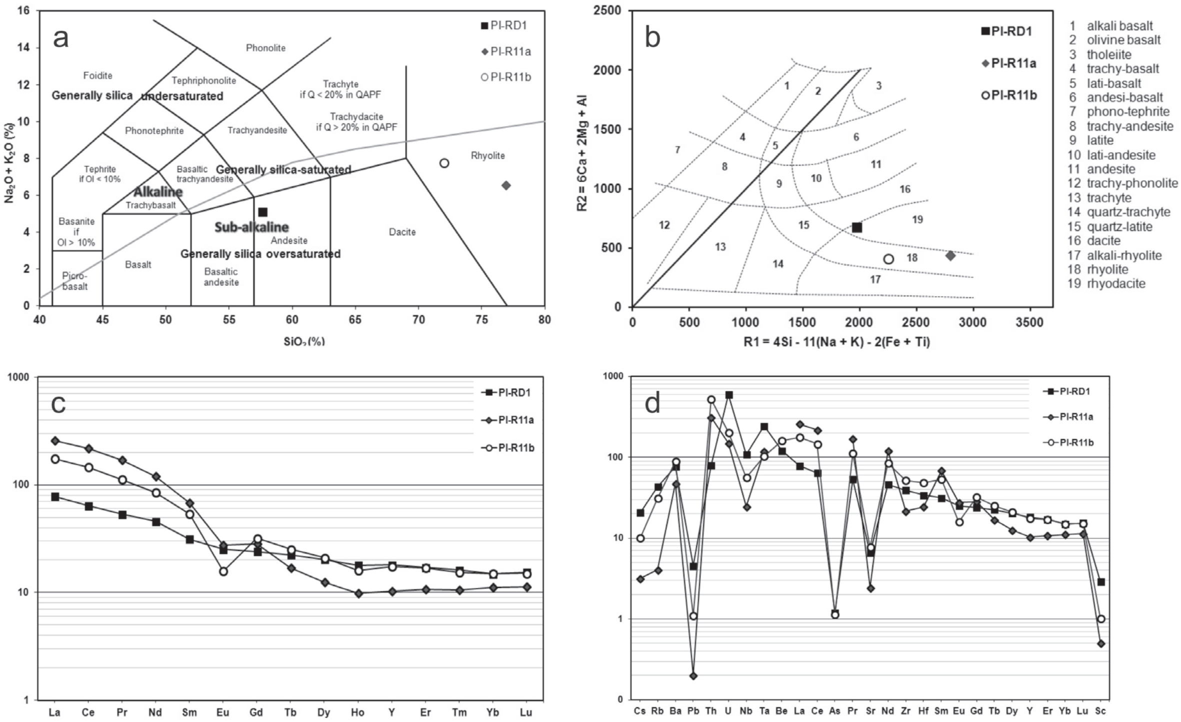


Fig. 3. Chemical composition and classification of dated rocks: a – TAS diagram for volcanic rocks after LeBas et al. (1986); b – Classification diagram after De La Roche et al. (1980); c – Chondrite normalized rare earth element patterns (normalization of REE and other trace elements according to C1 values after Sun and McDonough, 1989); d – Multielement (spider) diagram.

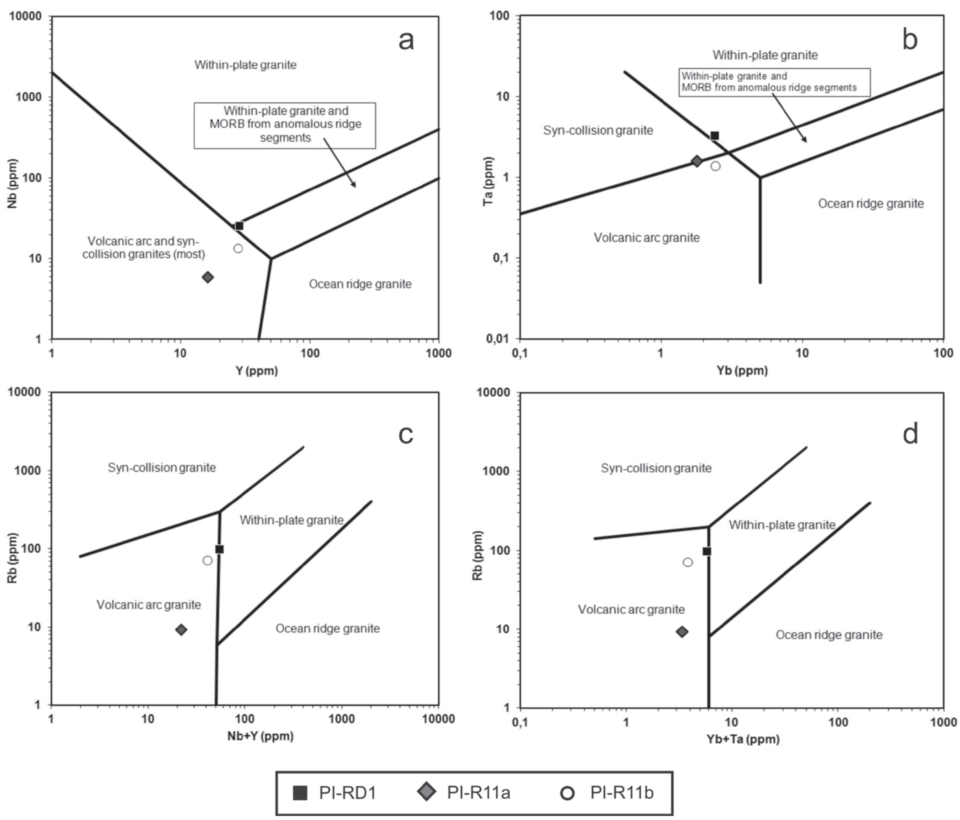


Fig. 4. Discrimination diagrams of granitoid rocks according to tectonic settings after Pearce et al. (1984).

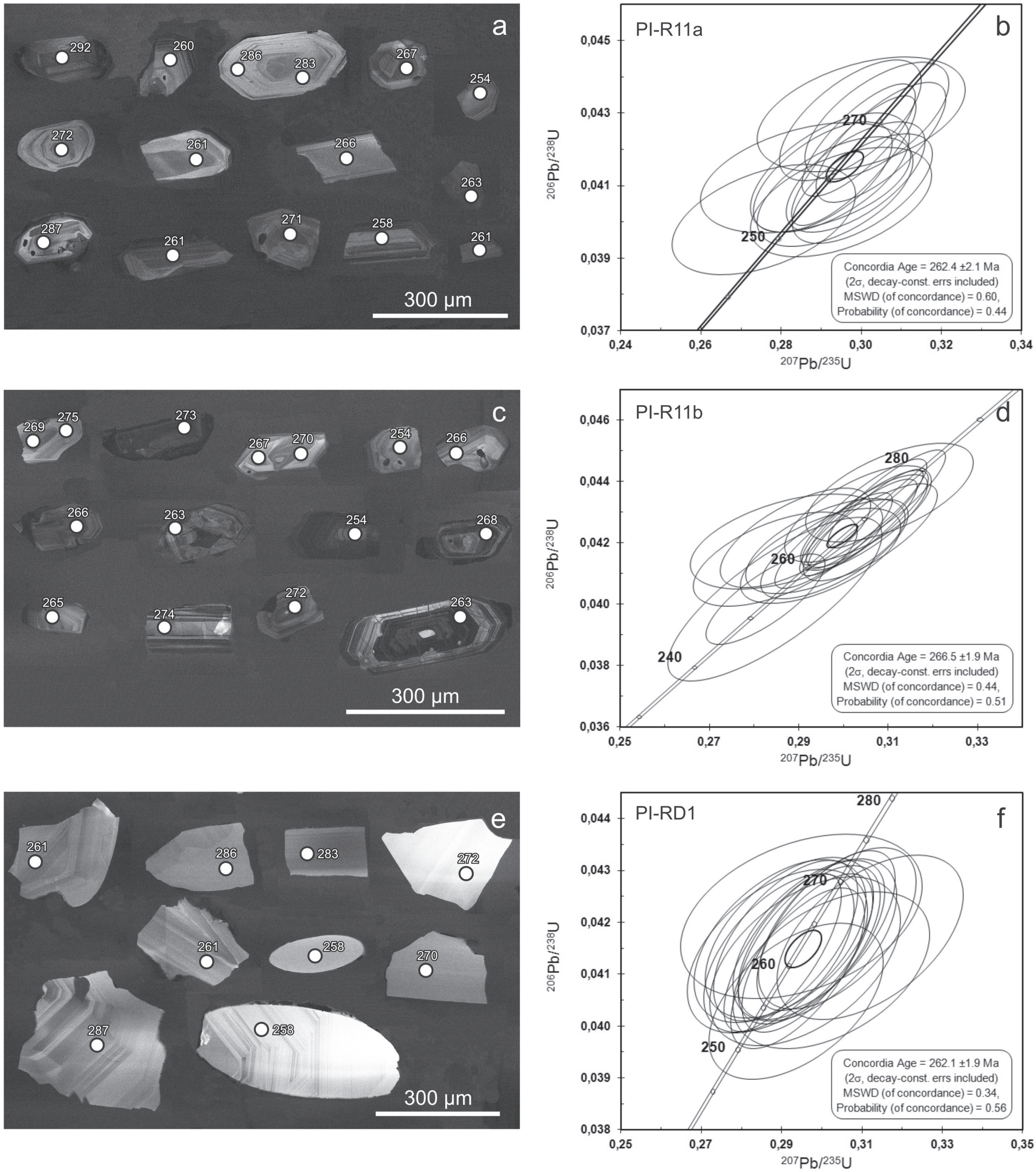


Fig. 5. Examples of CL images of dated 20*30 µm spots in zircon (a, c, e). Conventional U/Pb concordia diagrams (b, d, f) with concordia ages.

Conclusions

The acid volcanic rocks in the Infratatric Inovec Nappe of the Central Western Carpathians reflect significant zone of partial melting of continental crust in Permian. Association of basalts to basaltoandesites with rhyolites and rhyodacites may correspond to calc-alkaline to subalkaline volcanic suite characteristic for active continental margins. The rhyodacite dykes may indicate a significance of continental rifting.

The U/Pb SIMS zircon dating of acid volcanic rocks revealed the narrow time span of Permian – Guadalupian (Wordian to Capitanian) volcanic activity from ca 267 to 262 Ma. These ages are comparable with those from other Permian complexes of the Western Carpathians, which underwent Permian volcanic arc-type activity and/or extension and accompanying rifting, most likely related to supercontinent Pangea breakdown.

Such kind of volcanic rocks, including the Permian siliciclastic host rocks, are missing in the neighbouring Tatric pre-Mesozoic basement, including the overlying north-Tatric Panská Javorina Nappe in the Považský Inovec Mountains.

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U/Pb SIMS datovanie zirkónu ryolitovej interkalácie v permských sedimentoch a dajky ryodacitu v svoroch (infratatrikum, Z. Karpaty)

Článok sa zaoberá datovaním zirkónu kyslých vulkanitov typu ryolitov a dajky ryodacitu. Ryolity a ich pyroklastiká sa vyskytujú priamo v klastogénnych sedimentoch permu na svorových rulách inoveckého príkrovu infratatrika Považského Inovca v širšej oblasti Hôrčanskej doliny, resp. ako zavrásnené vo svorovo-rulovom kryštaliniku. Datovala sa aj dajka ryodacitu, umiestnená priamo vo svorových rulách severne od chaty pod Inovcom. Celohorninové chemické analýzy umožnili zostaviť grafy normalizované na chondrit (normalizácia s použitím hodnôt C1 podľa Sun a McDonough, 1989), ktoré ukazujú zvýšený obsah ľahkých prvkov vzácnych zemín vrátane miernej Eu anomálie v prípade ryolitu. Tieto charakteristiky, ako aj nízky obsah Y (Yb, Nb, Ta) premietajú ryolit a ryodacit do poľa vulkanického oblúka podľa diagramov granitoidov (Pearce et al., 1984). Ryodacit naznačuje skôr vnútroplatňový typ vulkanizmu. Datovanie potvrdilo úzky časový interval kyslého vulkanizmu, od 267 do 262 mil. r. Tento typ vulkanizmu je charakteristický pre vulkanizmus ostrovno-oblúkového typu a následnú riftogenézu vnútri superkontinentu Pangea.

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